What is claimed is:

1. A power supply device having an AC power supply, a rectifier which rectifies power supplied from the AC power supply, and a capacitor which smoothes power rectified by the rectifier, the power supply device comprising:

a switching unit;

a diode having a cathode connected to the capacitor and an anode connected to the switching unit;

an inductor having a first end connected to the rectifier and a second end;

a resistor having a first end connected to the capacitor and a second end;

a first relay which selectively connects a node between the switching unit and the diode to one of the second end of the inductor and the second end of the resistor; and

a controller which controls the first relay to connect the node and the second end of the resistor if a voltage applied across the capacitor exceeds a predetermined PFC voltage limit.

2. The power supply device according to claim 1, further comprising:

a capacitor voltage detector which detects the voltage applied across the capacitor.

3. The power supply device according to claim 2, wherein the controller turns on/off the switching unit if the detected voltage across the capacitor exceeds a predetermined overvoltage region in a state that the first relay connects the node and the second end of the resistor.

4. The power supply device according to claim 3, wherein the controller controls the first relay to connect the node between the diode and the switching unit and the second end of the inductor if the voltage applied across the capacitor and detected by the capacitor voltage detector becomes lower than the predetermined PFC voltage limit.

5. The power supply device according to claim 1, further comprising a second relay which selectively connects the rectifier with one of the first end of the inductor and the second end of the resistor.

6. The power supply device according to claim 5, wherein the controller controls the second relay to connect the rectifier to the second end of the resistor so that power rectified by the rectifier is supplied to the capacitor through the resistor when power is initially supplied.

7. The power supply device according to claim 6, wherein the controller controls the second relay to connect the rectifier to the first end of the inductor if the voltage applied across the capacitor exceeds a predetermined reference charging voltage in a state that the second relay is connecting the node between the diode and the switching unit and the second end of the inductor.

8. The power supply device according to claim 4, further comprising a second relay which selectively connects the rectifier with one of the first end of the inductor and the second end of the resistor.

9. The power supply device according to claim 8, wherein the controller controls the second relay to connect the rectifier to the second end of the resistor so that power rectified by the rectifier is supplied to the capacitor through the resistor when power is initially supplied.

10. The power supply device according to claim 9, wherein the controller controls the second relay to connect the rectifier to the first end of the inductor if the voltage applied across the capacitor exceeds a predetermined reference charging voltage in a state that the second relay is connecting the node between the diode and the switching unit and the second end of the inductor.

11. A method of controlling a power supply device having an AC power supply, a rectifier which rectifies power supplied from the AC power supply, a capacitor which smoothes power rectified by the rectifier, a switching unit, a diode having a cathode connected to the capacitor and an anode connected to the switching unit, and an inductor connected between the rectifier and a node between the switching device and the diode, comprising:

providing a resistor connectable in parallel with the diode;

detecting a voltage applied across the capacitor; and

disconnecting the inductor and the node between the switching unit and the diode, and connecting the resistor and the node between the switching unit and the diode, if a detected voltage applied across the capacitor exceeds a predetermined PFC voltage limit.

12. The method according to claim 11, further comprising:

turning on/off the switching unit if the detected voltage applied across the capacitor reaches a predetermined overvoltage region in a state that the resistor and the node between the switching unit and the diode are connected.

13. The method according to claim 12, further comprising:

disconnecting the resistor and the node between the switching unit and the diode, and connecting the inductor and the node between the switching unit and the diode, if the detected voltage applied across the capacitor becomes lower than the predetermined PFC voltage limit.

14. The method to claim 13, further comprising:

connecting the rectifier and the resistor and disconnecting the rectifier and the inductor so that power rectified by the rectifier is supplied to the capacitor through the resistor, when power is initially supplied.

15. A power supply device for supplying an AC motor from a source of DC power, the power supply device comprising:

an inverter having first and second inputs and which inverts a DC drive voltage to drive the motor;

a circuit selectively operable in an inrush current protection mode, a power factor correction mode and an overvoltage protection mode to control the DC drive voltage, the circuit comprising:

a capacitor having first and second ends and connected with the first and second inputs, respectively, of the inverter,

a resistor having a first end connected to the first end of the capacitor and a second end,

a diode having a first end connected to the first end of the capacitor and a second end,

a switching unit having a first terminal connected at a node with the second end of the diode, a second terminal connected with the second end of the capacitor and a control terminal,

an inductor having first and second ends;

a first relay which selectively connects the node to one of the second end of the resistor and the second end of the inductor, and

a second relay which selectively connects the source of the DC power to one of the second end of the resistor and the first end of the inductor;

a voltage detector which detects a value of the DC drive voltage;

a controller which drives the control terminal and the relays to cause the circuit to selectively perform the inrush current protection mode, the power factor correction mode or the overvoltage protection mode according to the detected value of the DC drive voltage.

16. The power supply device of claim 15, wherein:

the controller controls the relays and the switching unit to operate the circuit in the inrush current protection mode during an initial start up period where the detected value of the DC drive voltage is less than a predetermined value.

17. The power supply device of claim 16, wherein:

during operation in the inrush current protection mode,

the second relay connects the source of the DC power and the second end of the resistor, and

the first relay connects the second end of the inductor and the node.

18. The power supply device of claim 15, wherein:

the controller controls the relays and the switching unit to operate the circuit in the power factor correction mode where the detected value of the DC drive voltage is greater than a first predetermined value and less than a second predetermined value.

19. The power supply device of claim 18, wherein:

during operation in the power factor correction mode,

the second relay connects the source of the DC power and the first end of the inductor, and

the first relay connects the second end of the inductor and the node.

20. The power supply device of claim 15, wherein the controller controls the relays and the switching unit to operate the circuit in the overvoltage protection mode where the detected value of the DC drive voltage is greater than a predetermined value.

21. The power supply device of claim 20, wherein:

during operation in the overvoltage protection mode,

the first relay connects the second end of the resistor and the node, and

the second relay connects the source of the DC power and the first end of the inductor.

22. The power supply device of claim 18, wherein:

the controller changes the operation of the circuit from the power factor correction mode to the overvoltage protection mode where the detected value of the DC drive voltage is greater than the second predetermined value and greater than a third predetermined value.

23. The power supply device of claim 22, wherein:

the DC drive value increases above the second predetermined value due to a voltage regenerated from energy stored due to rotation of the motor.

24 . A power supply device for supplying input power to an inverter to drive an AC motor from an input power, the power supply device comprising:

a capacitance connected in parallel with the inverter;

a resistance which limits an inrush current to the capacitance during an initial application of the input power; and

an overvoltage protection circuit which selectively discharges the capacitance through the limiting resistance to limit a voltage across the capacitance to a predetermined maximum.

25. The power supply device of claim 24, further comprising:

a voltage detector which detects the voltage across the capacitance;

a switching apparatus which selectively connects the resistance to perform one of limiting the inrush current and discharging the capacitor; and

a controller which controls the switching apparatus in response to the detected voltage.

26. The power supply device of claim 25, wherein:

the overvoltage protection circuit comprises an active element selectively connectable in series with the resistance and which controls the discharge of the capacitance through the resistance; and

the controller controls the active element to control the discharge of the capacitance.

27. The power supply device of claim 26, wherein:

the power supply device further comprises an inductance, selectively connectable in series with the capacitance; and

the switching apparatus selectively connects one of the resistance and the inductance to be serially connected with the capacitance.

28. The power supply device of claim 27, wherein:

where the inductance is serially connected with the capacitance,

a diode is interposed between the inductance and the capacitance;

the active element is connected to an end of the diode; and

the controller operates the inductance, the diode, the capacitance and the active element to correct a power factor of the input power.